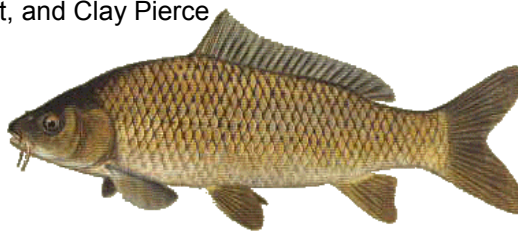# Lakes, Ponds and Reservoirs

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Effects of Introduced Common Carp and Invading Zebra Mussels on Water Quality and the Native Biological Community of Clear Lake, Iowa

The objective of this study is to understand the complex interactions and effects of introduced common carp, invading zebra mussels, and the native biological community on water quality in Clear Lake, and to organize this knowledge into a simulation model. The resulting model will enable the evalauation of the effects of both biotic and abiotic factors on water quality in Clear Lake, and facilitate evaluation of a variety of management scenarios on future water quality. Our simulation model will provide a tool for scientists, managers and other decision makers to evaluate effects of potential ecosystem changes and management actions on water quality and recreational fisheries in Clear Lake and other similar systems.

The project has had four field seasons completed during 2007-2010. The adult carp population was estimated to be 35,738 (95% C.I.= 29,756-41,694), 59330 (95% C.I. = 50,072-68,588) and 32615 (95% C.I. = 25889-39342), 62003 (95% C.I.= 54134-69872) individuals in 2007, 2008, 2009, and 2010 respectively based on mark-recapture population estimates. Estimated biomass per hectare was 92.62 (95% C.I. = 86-99) and 211.89 (95% C.I.= 203-221) and 126.85 (95% C.I.= 100.7-153.0) in 2007, 2008 and 2009 respectively. The fish assemblage has been dominated by walleye, yellow bass, and common carp on estimated densities and biomass of nearshore and offshore fish species. The age 1+ fish assemblage was generally similar in 2009 compared to 2007 and 2008, but few bullhead were captured in 2009 and 2010 reflecting a major decrease in black bullhead abundance. Age 0+ seine catches of yellow bass, yellow perch, and forage fish (e.g., spottail shiners, fathead minnows) in 2009 and 2010 were dramatically increased relative to 2007 and 2008.

Benthic invertebrates assemblages were dominated by chironomidae in mud and muck benthic substrates and zebra mussels on rocky substrates. Zebra mussel densities on rock substrates was 1,032,508 inviduals meter^{-2} in 2009, a 7.8 fold increase from 2007. Settlement of zebra mussels on colonization plates and benthic surveys indicate that the zebra mussel population was more abundant in 2010 than 2007 and have colonized the majority of suitable habitat in the lake. Zebra mussel (>2mm) densities on colonizaton plates was overall lower in 2009 and 2010 compared to previous years.

A preliminary ECOPATH model of the system has been completed and in the prosess of being written up for publication (target journal: Ecological Modeling). Additional submodels (e.g., sediment resuspenstion, water quality) of the overall ecosystem model are in stages of development, parameterization, and integration with the ECOPATH model. Several presentations were made at various meetings at the state, region and national level.

Check out the project web site at: www.public.iastate.edu/~mcolvin/index.htm. Check reports on Clay's website (www.cfwru.iastate.edu/pierce_reports.htm) for a complete version of this report. Visit the project web site at: www.public.iastate.edu/~mcolvin/index.htm.